SECTION **5**
INFORMATION TECHNOLOGY
ARCHITECTURE

INFORMATION TECHNOLOGY ARCHITECTURE

FEATURED IN THIS SECTION

SECTION 5
INFORMATION TECHNOLOGY ARCHITECTURE

5.1 ENTERPRISE ARCHITECTURE

This section identifies the current information technology architecture implemented in Fairfax County. The County's technology architecture is a strategic asset that defines technology components necessary to support business operations and the infrastructure required for implementing new technologies in response to the changing needs of government business. It is a multi-layered architecture that includes:

- Application and Data Architectures
- Platform Architecture
- Network Architecture
- Internet Architecture
- Security Architecture

5.2 IT ARCHITECTURE PROCESS MODEL

Fairfax County has adopted Enterprise Architecture (EA approach) as the blue print or roadmap by which specific technology solutions are developed. Architecture defines the manner in which technology is used to enable business solutions that are flexible, and allow expansion and change as requirements evolve or technology is updated or becomes obsolete. Architecture as a foundation and roadmap enables the County to assess the impact of new requirements and evolving technologies and allows for the incorporation of new technology as part of an updated blueprint that benefits other solutions. Enterprise Architecture improves the efficiency and effectiveness of technology investments by reducing redundancy, and promoting the sharing of knowledge and best practices across county government.

The Enterprise IT Architecture Process Model on the following page illustrates the inter-relationships between the County's IT and business architectures, an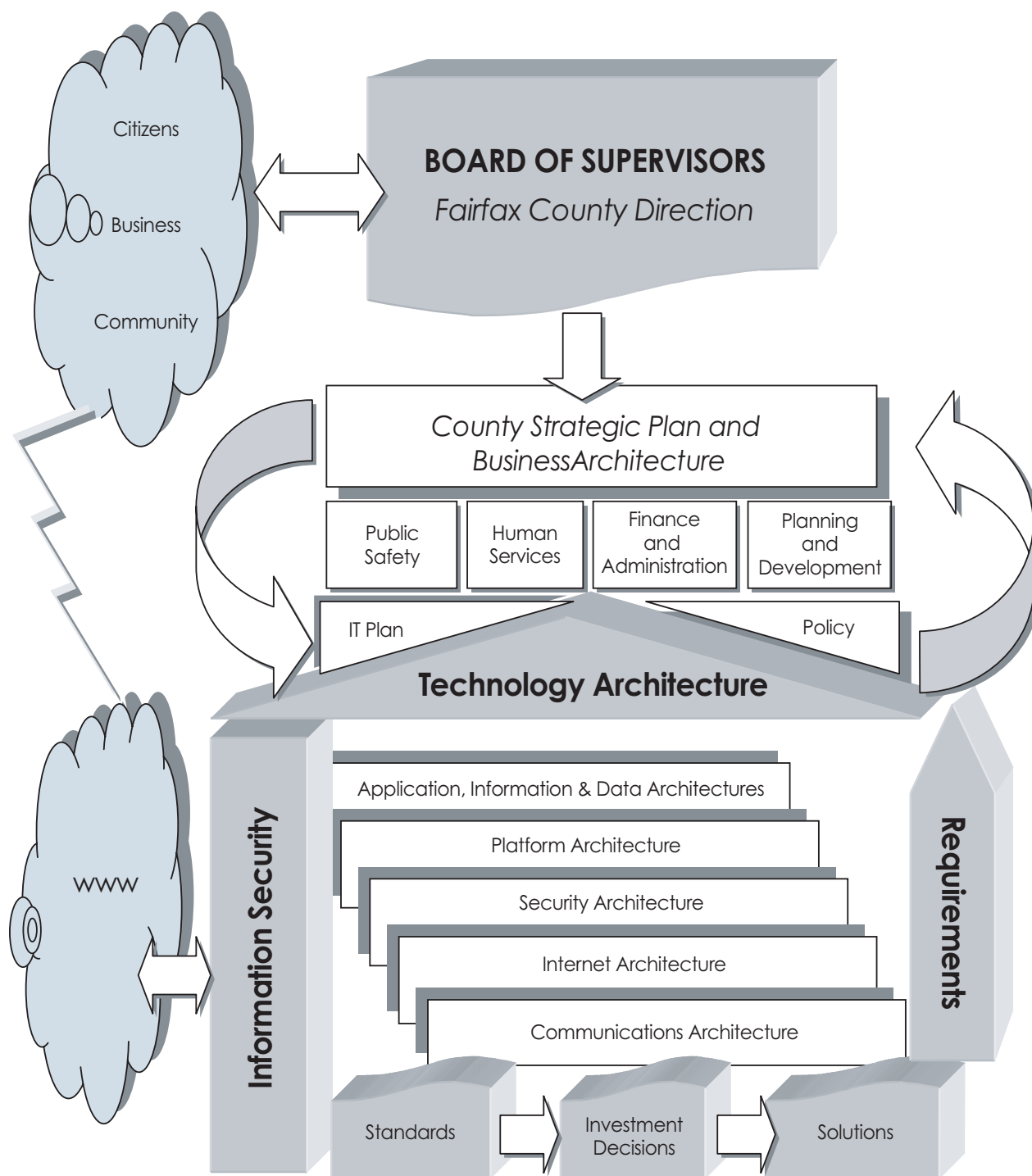d the iterative processes involved to ensure the development of an IT architecture that is efficient, cost-effective and business driven. For the purposes of the County's model, the business processes have been grouped into four major functional areas; Human Services (HS), Public Safety (PS), Planning and Development (PD), and Finance & Revenue (F&R), which reflect the compartmentalization of County services for delivery as well as evaluation purposes.

The model is based on the mission statement for Information Technology, specifically:

> *"Delivery of quality and innovative information technology solutions for agencies and those doing business with Fairfax County Government."*

This mission directs the County's information technology activities. Every effort undertaken is framed against this mission statement.

ENTERPRISE IT ARCHITECTURE PROCESS MODEL

Citizens

Business

Community

BOARD OF SUPERVISORS

Fairfax County Direction

County Strategic Plan and BusinessArchitecture

| Public Safety | Human Services | Finance and Administration | Planning and Development |

IT Plan

Policy

Technology Architecture

Information Security

Application, Information & Data Architectures

Platform Architecture

Security Architecture

Internet Architecture

Communications Architecture

Requirements

WWW

Standards

Investment Decisions

Solutions

5.3 APPLICATION & DATA ARCHITECTURE

Application architecture defines the design and correlation among applications. Architecture promotes common development and presentation standards, enables optimum system integration, provides shared opportunities for storage and retrieval of data, facilitates the reuse of components, and the rapid deployment of applications in response to changing business requirements. Application Architecture includes elements of technology architecture that converts business process to business intelligence to support the County's goal of delivering timely, efficient and cost effective services. In Fairfax County a vast inventory of enterprise-wide and agency specific production applications reside on mainframe, server, and desktop computer platforms. New applications and application enhancements are constantly being evaluated, developed, acquired, and implemented as older "legacy" applications retire.

The County's goal is to use and create industry standard application development tools and language environments that are adaptive in client/server and Web-enabled models. Application architecture protects the County's investment in 'classic' systems by providing enhancements that facilitate enhanced user-friendliness, improved data manipulation, reporting, and end user controls. In addition, by keeping abreast of emerging technologies such as Web Services, XML, the County positions itself to take advantage of emerging opportunities offered by these technologies. An exhaustive discussion is beyond the scope of this section; however, some examples of the County's application architecture and some recent developments are described here.

As the County moves toward a balance between Commercial-Off-The-Shelf(COTS) vs. in-house development, there is a transition to a new framework for application development. The new framework incorporates Software Engineering, Information Architecture, and Application Development Methodology. These principles and techniques are used to augment the current Systems Development Life Cycle Standards (SDLCS). The resulting approach encompasses application life cycles from "cradle to grave"; that is, from the earliest stages of planning, through requirements and design, to implementation and post-implementation support. New applications will be built on the most current and promising platforms and an architectural framework based on the future of IT. While support for existing legacy systems will continue, a dramatic move is also underway to embrace new development platforms such as .Net and emerging standards such as XML and Web Services.

The .Net platform provides the foundation for the next generation of both departmental and enterprise-wide applications and offers a stable application environment with more opportunity for componentization of business logic, sharing of common components and the integration of business processes across application boundaries. A new class of tools such as Visual Studio.Net provides County developers with a robust and flexible development environment. Encapsulating both existing and new business logic into "Web services" provide the ability to expose business processes across organizational and application boundaries, within the County, other local jurisdictions, the state, the federal government, as well as business partners. XML provides the common "glue" to hold together and provide consistent information across boundaries to facilitate data sharing among disparate platforms and systems. Enterprise Application Integration (EAI) products such as WebMethods allows virtually unlimited ability to share, incorporate information and business process from older, mainframe and client/server applications into the new environment. With the ability to extend business processes further through the use of ASP code, the end product will be greater than the sum of the parts. A detailed "Architectural Framework" document has been developed, and is intended to be an organic document flexible enough to reflect and incorporate rapid advances in information technology.

Office Systems — Fairfax County uses the MS Office Suite installed on PCs attached to LAN-based servers, appliances and printers to facilitate shared file and printing requirements for word processing, spreadsheet, groupware presentation software, workflow database applications, project management and collaborative group work process and workflow. E-mail is MS Outlook on the desktop supported by Microsoft Exchange on an enterprise-class server.

Production Applications — Fairfax County is in the midst of overhauling and updating many of its administrative applications as well as acquiring new applications. Key applications in the midst of

development or further enhancement include the County's land development systems, tax systems, public safety systems, various human services systems, and human resources management systems. DIT maintains approximately 65 mainframe-based classic applications for Fairfax County agencies that support finance, purchasing, personnel, public safety, and planning and development of business operations. Most of these applications are modified package software, that run under CICS, using programming language architectures such as COBOL, SAS and EASYTRIEVE PLUS, with DB2, IDMS and VSAM databases. Efforts are underway to convert IDMS based applications to new technology. The current mainframe ('enterprise server') is an IBM 9672 with 3 terabytes of storage, running z/OS. Access to the mainframe systems is provided via the county's LAN by mainframe terminal emulation software on the desktop. The mainframe systems utilize text–based screens with user knowledge required of the application commands and function keys.

DIT deployed Web-enabled GUI front-end versions of several mainframe applications to facilitate easier access to system data. In addition, the classic COTS financial suite has been enhanced through the use WebMethods, the County's middleware EAI software tool which ties the two COTS together. The change created an integrated process for entering financial transactions through a modern, user friendly Windows interface. There are several projects underway to use EAI and Web-enable other corporate systems to build in web services, work flow and desktop reporting capabilities, meeting end user demands for GUI

5.3.1 The Application Tools

Application tools are the information technology components used to develop and support application functions.. Application tools include the support systems required to facilitate work planning and communications.

Programming/Development Tools — New applications are currently under development using fourth generation object oriented languages and tools. This approach will continue as additional client/server applications are developed and as Commercial-Off-The-Shelf (COTS) system components are purchased. Standard life-cycle methodologies are employed to define, develop and implement new systems. The models, design, and documents created are updated throughout the system development and maintenance life cycle. In specific instances, expert

access to County business data. DIT also provides first tier support for over 100 server-based applications for agencies that provide Windows GUI access to a server resident database. Most of the server applications are "fat client" in nature with ORACLE or SQL as the primary database residing on UNIX and/or Windows servers. Some of these are being upgraded to web-based applications.

There are also "fat client" and web-based agency specific applications that are maintained separately by agency IT staff. The large majority of the small agency applications use Microsoft Access or Microsoft SQL Server as their database and programming language architecture. The IT standards call for complex, Internet accessible or high access databases to use Microsoft SQL Server, Oracle or DB2 as appropriate. Most agency server-based systems reside on Windows 2003 servers that support both applications and file and print server-sharing requirements.

Geographical Information System Applications (GIS) — GIS is a specialized system for storing, retrieving and analyzing an array of digitized map layers that collectively record the topographic, demographic and other features of every location in the County. GIS can be used to identify the shortest route from one location to another, generate school bus and sanitation truck routes, locate sewer lines and other utilities, plan development and many other useful tasks. Our system currently has over 200 layers of GIS data. The County continues to develop its GIS data and implement new applications in support of agency functions. GIS is supported on the UNIX platform.

system technology is used to incorporate complex rule based functionality into systems. Third and fourth generation languages and tools are used in only a few specific development efforts and as utility programs on the mainframe tier of some client/server systems. New developments use ASP and ASP.NET and *Dreamweaver* for the presentation layer. The County uses webMethods, a suite of tools to assist in the integration of applications at the presentation, business logic, and data layers. Documentum is the County's enterprise content and document management software solution. The County also supports REAMS imaging solution. Software Engineering technologies are being incorporated into the Systems Development Life Cycle Standards (SDLCS) to provide a disciplined and consistent development approach.

Database Management Systems (DBMS) — The County uses several database management systems to support its business applications. Mainframe classic and legacy applications use DB2, IDMS, and/or VSAM databases. DB2 is the preferred database solution for new mainframe hosted applications. For UNIX or Windows platforms, Oracle and Microsoft SQL Server are the County's database standards. Oracle Gateway, Neon's Shadow Direct, and webMethods are used to enable access of mainframe DB2 databases. Relational database design activities, such as developing entity-relationship diagrams, data dictionaries, process models, logical and physical data models, and database definition languages, are supported through the COOL: BIZ and ER/WIN tools.

Departmental Reporting — Business Objects/Crystal Reports, SAS, QMF, SQL Reporting Services and Easytrieve Plus are the current tools supported for basic ad-hoc query and departmental reporting.

Enterprise Decision Support Systems and Business Intelligence — The County's portfolio currently contains over 20 different products used for reporting, analytics, and decision support. Many of these products were brought into the environment through purchase of a COTS solution with embedded tools. As a result, the County's business intelligence capability is built on department-class rather than enterprise-class technology. The proliferation of tools and the associated support, training, and infrastructure costs present a strong business case for rationalizing the portfolio. The County's strategy in this regard is to provide shared enterprise capability and infrastructure for decision support. To that end, the County is currently assessing a variety of platform solutions including SAS, Business Objects, and others that could facilitate the consolidation of isolated point solutions. As standards are defined for the County's enterprise solution(s), the portfolio will be rationalized into fewer products over time. This approach will enable DIT to upgrade and modernize the existing portfolio while creating economies of scale for improved support and cost control.

Office Automation/Workstation Software — The County has adopted Microsoft Office Suite for general productivity automation tools including Word for word processing, Excel for spreadsheets, PowerPoint for presentations, Access for desktop application databases, Exchange/Outlook for e-mail/groupware, and Internet Explorer for Web browsing. Other desktop software includes Microsoft Project for project management/tracking, VISIO, and Symantec Antivirus. Agencies may have other desktop based software for special requirements.

GroupWare/Collaborative Software — The County uses Group Systems as its primary collaborative group software in the Group Decision Support Center. Groups use the computer-supported meeting center and its software to conduct process improvements, strategic planning, program evaluation, and vendor selection sessions. Other software is used to support activities dealing with the group output/results, e.g., Microsoft Exchange, Word, Excel, databases, presentation and process modeling software.

GIS Software — The ARC/INFO software provides high-end workstation tools and functionality to the GIS analyst. The software integrates visual or graphic data in the form of maps, with descriptive or attribute information from an organization's internal databases. ARC/INFO provides the tools for analysts

to access, visualize, and query both graphic and tabular data for better analysis and decision-making. Additionally, ArcView GIS provides mid-range desktop GIS tools to the skilled-user for map creation and analysis of the County's geographic data sets. And finally, MapObjects and the Internet Map Server provide a method for distributing highly customized GIS based applications through the Internet /Intranet.

IT Service Desk software — The IT Service Desk provides County employees a centralized point of contact for computer support. InfraEnterprise is the WEB based solution used to support the Service Desk function using the ITIL framework. The Automatic Call Distribution telephone system is used to route calls. The Service Desk also uses diagnostic tools such as Microsoft Technet, the InfraEnterprise Knowledge Bank, and technical documentation for resolution of incidents involving key systems supported by DIT in the IT inventory. The IT Service Desk has a high percentage rate of first-call resolution.

5.4 PLATFORM ARCHITECTURE

Platform architecture defines the technical components of the infrastructure including server and client platforms, the operating systems and interfaces supported, as well as other software tools and equipment used to operate the applications. Fairfax County's platform architecture includes over 600 servers: z/OS mainframe, UNIX (IBM AIX, Sun Solaris and Unisys ES) and Microsoft Windows 2003. Over 12,000 PC's provide end-user access to County systems. Laptops, Blackberries and other PDAs and hand-held devices also support employee access to Agency business systems.

All Personal computers are standardized using Windows XP Service Pack 2 and the Microsoft Office 2003 to support office automation requirements. VISTA is being rolled out in a few agencies with a careful full deployment strategy. Total server storage requirements have grown from 394 gigabytes in 1998 to the current total of over 300 terabytes. The County also uses state and other non-County hardware platforms as necessary. The following paragraphs describe the major features of the County's platform architecture.

5.4.1 The Platforms

Desktop PCs, Workstations and Peripherals — DIT prescribes hardware platforms and desktop applications standards as well as procurement vehicles to optimize support and costs. Desktop computers (PCs) are replaced in accordance with the County's four-year PC Replacement Program cycle using adopted standards bundled with the MS Suite. THe PC Replcement strategy applies to all agencies and provides the County economies of scale as well as a more robust, effective support environment.

The current desktop computer platform standard consists of Pentium 4 and above processors running the Microsoft Windows XP Service Pack 2 operating system. County PCs are used for office productivity software, enterprise e-mail and groupware, application client software, Internet/Web access, and mainframe emulation. Office configuration standards are depicted in the diagram on the next page followed by a table listing all County IT Standards for desktops and servers. The next wave of PC replacements to be deployed is Windows XP Service Pack 2 and some

Windows Vista. This will be approximately one-fourth of the installed base. Vista and MS Mobile Web will be evaluated for the next deployment enhancement.

Desktop and network printing is accomplished through a large inventory of stand-alone and network printers and appliances. Agencies use a variety of laser-jet type desktop and high speed LAN based printers in offices. In 2003, the county's copier inventory became an enterprise multi-function copier/printer/scan/fax machine asset. In FY 2005, this program was moved to the Department of Information Technology and incorporated into an enterprise printing solution strategy. DIT incorporated the County fleet of over 500 network attached multi-function multi-user machines, and 1500 workgroup based local printers.

LAN-based Network Servers — Fairfax County LAN server environment utilizes Microsoft Active Directory services as a standard for directory services, authen-

tication and authorization, which are essential components of the Microsoft Windows 2003 architecture. However, the County still supports Microsoft Windows 2000 Server for required legacy applications. In addition to the current Windows 2003 servers the County also supports UNIX servers that are used for those large agency specific applications and enterprise infrastructure applications that require a more robust server platform. SUN is the preferred UNIX server; however, the IBM p-Series is still supported. The County supports virtualization as a standard platform for LOB and infrastructure applications where feasible. Enterprise-class Intel-based server technology (e.g. UniSys ES 7000, DELL/IBM Blade servers) supports some of the County's enterprise infrastructure applications such as Exchange, SQL, Citrix, etc.

CITRIX Presentation Servers are used for many of the business applications that require "thin-client" technology to minimize Wide Area Network traffic, optimize the efficiency of fat client-server applications, and streamline desktop PC support activities. CITRIX also support secure access for remote access users and telework. Details on managed LAN-based servers:

Mid range Platform	Number of Servers
AIX	12
W2K3/W2K	700
Solaris	25
Unisys	6

Mainframe (Enterprise Server) – Fairfax County supports its major business and legacy applications on an IBM mainframe running the z/OS operating system. It is partitioned into logical machines, serving over 20,000 agency and schools users at over 200 locations.

Device	Machine
Mainframe Computer	IBM zSeries, Z890 Model 240 8GB Real Storage
Tape Subsystem	IBM 3494 Automated Tape Library IBM 3590E Drives IBM 3480 (cartridge)
Printers	IBM 4100 Laser IBM 3900 Laser IBM 6400 Line Matrix

5.4.2 Storage Area Network

In FY 2002, Fairfax County implemented its first Storage Area Network (SAN). This enabled data to be stored in a centralized location, with redundancy and failover, mitigating the risk of data loss due to hardware failure. Data from all servers (mainframe, UNIX, Solaris and INTEL) could now coexist on the same disk subsystem. In 2006, the County refreshed the enterprise disk arrays and fabric with EMC DMX-3 disks and Cisco fabric. The refresh positions the County for future growth and to meet the strategic initiatives for Data Lifecycle Management.

Storage Management requirements addressed by the SAN are:

- Scaleable storage capacity that allows users to increase their storage as needed.

- Modular, adaptive architectures which allows users to deploy storage in a variety of centralized and distributed environments with re-deployment capabilities as needed.

- Highly available architectures to prevent downtime.

- Cross-platform solutions that support a variety of operating systems, allowing users to reduce costs by standardizing on a single enterprise storage solution, rather than operating system specific solutions.

- Higher levels of performance to support the ever-growing volume of online data.

- Higher performance backup and restore operations to support shrinking backup windows.

- The ability to share data across the enterprise rather than building "islands of data."

- Easy to use, centralized management tools that allow hardware and data to be "distributed."

Storage Area Network Details:

Device	Machine
Disk Subsystem- Intel & Unix	EMC DMX3 EMC CX500, CX3-80
MS Exchange environment	EMC CX700
Tape Subsystem	IBM 3494 Automated Tape Library IBM 3590E Drives Spectra Logic 64K Tape Library SpectaLogic 20K

5.5 NETWORK ARCHITECTURE

The County's communications infrastructure includes voice and data technologies and the various topologies, transmission services and protocols necessary to facilitate the interconnection of server platforms, intra-building and office networks (LANs), and inter-building and campus networks (WANs). The County's voice and data networks continue to grow, in terms of cost, sophistication, and increased demand on the County's communication staff.

The Communication Group in DIT supports over 12,500 data ports and over 15,000 voice ports. Additionally, initiatives already in place and those planned have resulted in many significant changes with many more occurring in the future. The Gartner Research Group and others now document that network technologies refresh every 18-24 months. This will provide more challenges for County fiscal and staff resources, as the County strives to keep network standards in line with evolving business requirements, security and other support needs. The communications plan strives to take into account growth, based on the needs of County agencies as programs expand, which in turn require new or expanded network resources to provide both intra and inter County links. The Internet and Web-enabled applications have rapidly expanded. This expansion and the need for business continuity required the expansion from a single high capacity DS3 to two full 45 Mbps circuits connected to two separate ISPs. Future

initiatives and technologies, such as e-Government applications, streaming video, teleconferencing, and more integrated and complex applications drive the requirements for the County's communication infrastructure and its components, thus the requirement to update and/or enhance annually. During FY 2004 the County replaced its Wide Area Frame Relay network with a new ATM logically meshed network. The desire for increased network security has resulted in the County employing Network Address Translation (NAT) to add another security layer to protect its Enterprise Network.

The goal is to provide a network that is responsive and reliable for the user and the user's application and allows for the uninterrupted flow of voice, data, and video information. To this end, the County is working on several projects that will boost and consolidate the underlying physical infrastructure supporting voice, data, and video, while at the same time providing increased, cost-effective bandwidth potential, and improved output. The best opportunity recognized is through the implementation of the I-NET, a metropolitan fiber ring that connects over 400 County and Schools facilities. The County views a strong, viable communications infrastructure as a vital component in the overall IT strategy toward maintaining its success in deploying cost-effective solutions that optimizes its business goals, and maintains its reputation as a leader in technology.

5.5.1 Enterprise Data Communications Network

The Enterprise Data Communications Network for Fairfax County Government serves as the data communications backbone that provides countywide access to information technology resources. Operated by the Department of Information Technology Infrastructure Division, the Enterprise Data Network

connects approximately 14,000 computer devices in over 300 locations. These computer devices include personal computers, printers, network servers, communications equipment (routers and switches), modems, UNIX workstations and servers, mini-computers, and the mainframe computer. Additionally,

various wireless technologies are rapidly expanding throughout the County's network. The County began a project utilizing commercial broadband wireless infrastructure to support wireless applications, data, images, and live video to the field and mobile devices supporting primarily public safety responders and evolving for other key business areas.

All supported network systems are based upon open standards, and compliance with published standards is required for any network-connected device or system. The County standard network protocol is TCP/IP. Gigabit Ethernet is the standard backbone speed in the County and 100MBPS is the standard desktop speed.

The Enterprise Wide Area Network (WAN) is built of two different architectures. One: I-Net or Institutional Network utilizing the dark fiber provided to the County through the COX and Comcast Cable Franchise Agreements. I-Net spans seven hub sites and two key resource centers, Massey Public Safety Campus and the Government Center. These sites are networked via a 10 gigabit DWDM fiber optic backbone. The I-Net DWDM backbone provides connectivity to 180+ remote sites running a 1 gigabit uplink from the backbone to the site. I-Net also employs MPLS (Multiprotocol Label Switching) to allow I-Net to service many types of diverse traffic whether it is enterprise, public access, or voice over IP. Through MPLS each type of traffic can be separated logically for security support, as in enterprise vs. public access, or prioritized in the case of voice traffic. I-Net has now positioned the County Data Communications Network to respond quickly to the ever-changing technology needs of its customers. The remaining WAN sites are supported via Verizon ATM and TLS services.

The County also utilizes both ISDN and DSL technologies for small sites such as group homes and park maintenance shops. The decision to use these technologies is based on staff size and data requirements of the staff. Use of the ISDN technology is being phased out in favor of I-Net, ATM, of DSL.

The creation of a Public Access Network in FY 2005 was an addition to the Enterprise Wide Area Network (WAN) Architecture. This network provides public access computers to the citizens of Fairfax County providing them access to County and Internet resources while protecting Fairfax County's Enterprise Network. The Public Access Network includes all public libraries and community and recreation services sites. The design provides for separate physical networks at each site while sharing the existing WAN infrastructure and using logical separation on the WAN. A firewall between the Enterprise Network and Public Access Network allows for County IT staff to manage the infrastructure down to the desktop for each site. This model will be the standard for any new facilities requiring both enterprise and public access.

The County will continue to implement wireless LANs and wireless data over commercial systems, when this technology makes good business sense. The County carefully evaluates the use of this technology to ensure all County data is protected from unauthorized access. Currently, non-broadcast SSID's, MAC address registration, and digital certificates are required to gain access to the private WLAN. VPN technology is employed to protect data over commercial services.

Network Management is currently supported on four platforms:

1. CISCO Works 2000 — Monitors all Cisco installed equipment.

2. Orion Solarwinds — Monitors I-Net infrastructure for up/down alerting and performance issues.

3. Verizon Managed Services — provides fault reporting of all ATM sites.

Currently, mainframe connectivity is achieved through two primary gateways. First, a Cisco router using CIP (Channel Interface Processor), connects directly to the IBM Mainframe through a fiber-optic channel and supports a majority of the TN3270 (Telnet) sessions to the mainframe; second, an IBM 3745 Front End Processor is used to support the legacy SNA network sessions. The 3745 is being replaced during FY 2008 by moving this type connectivity directly onto the new Mainframe over native Ethernet, a capability not previously available.

The County has implemented a 'SAFE' architecture dividing our perimeter into five business groups E-Commerce, Internet Access, Partners, Emergency Operations, and Public Access. Each group has its own physical firewall tailored for that specific business area. The E-Commerce business group supports all public facing web services providing access to county resources for both citizens and businesses. The Internet business group is used to control county employee access to the internet and allow for content and virus scanning. The Partners business group

allows for connections to external "Trusted Partners" to include Fairfax County Public Schools, Fairfax County Water Authority, Commonwealth of Virginia (State Police, State Health, Department of Social Services, Supreme Court, Department of Juvenile Justice, and State Board of Elections) as well as public safety connections for several adjoining jurisdictions. The Emergency Operations group was setup to secure the Emergency Operations Center providing IT resources to the Department of Emergency Operations. The final group Public Access was established to secure the Public Access network built for the Libraries and Community and Recreation Services. By doing so the County has increased firewall performance and limited exposure to each business group.

Remote access via dial-up, VPN, and Citrix services provides access to the County's Enterprise Network resources for telecommuters, vendors, remote access users, or business travelers, as well as several small Fairfax County offices. Security for remote access is managed through a Remote Access Server using security tokens and PIN numbers.

5.5.2 Institutional Network (I-Net)

Over the past year the County has designed and implemented a new network (I-Net) utilizing dark fiber provided to the County through the Cable Franchise Agreements with COX Communications Northern Virginia and Comcast of Virginia.

Fairfax County's I-Net is one of the largest and most complex local government networks in operation. This carrier-class network comprises of over 4,000 km of single mode fiber (SMF), in a ring, hub and spoke topology. There are seven Hubsites that are redundantly connected in a ring.

The I-Net is one of the most viable, cost-effective and technologically advanced solution that the County has experienced since computers first appeared in the County's technology inventory. The fiber optic infrastructure enables the County capabilities to transport data, voice and video. Through the I-Net the County will reach its ultimate goal of converged voice, data and video technologies. The I-Net can provide services such as high speed data, Voice over IP (VoIP), broadcast video, video conferencing, streaming video, and distance learning. The network has several origination points, and facilities for controlling the switching and routing of data, voice and video signals among all participating sites.

Although broadband service is available through local telecommunication companies, it comes at a significant price, a loss of flexibility, and for some services, only limited availability. The I-Net provides bandwidth that is virtually "unlimited" while meeting the County's present and future communication requirements. The I-Net is becoming the "super highway" for the County's internal video, voice and data communications. The virtually "unlimited" bandwidth provided by the I-Net allows the County to amortize its cost over the life of the I-Net with an overall long-term operating cost savings.

I-Net Voice/Data Service

See sections 5.5.1 and 5.5.3 for detailed information.

I-Net Video Network

The Video Network is a scalable integrated video transport system. The Video Network provides a high quality image delivery system with scalable bandwidth, capacity, and growth potential for future Fairfax County Government and Fairfax County Public School applications. The Video Network provides video services to over 400 Fairfax County Government and Fairfax County Public School facilities.

The I-Net video network transport has two distinct communication links. Coarse Wave Division Multiplexing (CWDM) is the transport technology to provide forward and reverse transport for I-Net enabled County facilities.

The forward (downstream) transport provides select cable TV operator channels and local origination content produced by the Video Production facilities for services such as distance learning. Each I-Net enabled facility is equipped to transmit reverse (upstream) video to the County's video production facility for processing.

5.5.3 Voice Communications Network

The County's Voice Communications Network provides voice communications services to all Fairfax County Government agencies, as well as various affiliates via County-owned systems located in buildings throughout the County, connected via telephone company lines and several direct County-owned connections serving several campus locations. Voice communications services are managed centrally through the network, supporting local and long-distance calling, call centers, IVR (Interactive Voice Response) systems, voice mail, conference bridge and audio-video teleconferencing, hot-lines and special '800' numbers for specific programs, industrial systems monitoring devices, and residential services for County-operated group homes and apartments. Management and voice communication support are also provided for the primary and backup '911' communications centers. In addition cell phones are centrally managed.

The total environment includes approximately 400 sites, comprised of two major campus environments, several large Human Services centers, Parks, Libraries, Police, Fire and Rescue stations, "911" Centers, Public Health Centers, etc. Additionally, there are lines to over 300 water, sewage and HVAC systems end points, as well as links to various agencies of the Commonwealth of Virginia and other local jurisdictions.

DIT supports over 20,000 phones, until the completion of the Telecommunications Modernization project which spans several fiscal cycles, uses a combination of CPE platforms. During an average month the County places over 1.3 million calls excluding intra-building calls. Below is a brief, but by no means complete, summary of the current County's voice communications infrastructure (much of the assets detailed below will be replaced by the Telecommunications Modernization Project).

The main government centers and large buildings are serviced by Siemens PBXs and Nortel Meridian Option 61C PBX systems; all having integrated voice-mail systems. Fairfax County's main Government Center's voice traffic is served with a four-node legacy Siemens 9751-70 and the County's Public Safety Center located at the Massey campus with a two-node Siemens 9751-70. These systems, as well as several other large building systems are interconnected via DS1 tie lines, which reduce some of the message unit charges from Verizon. **This will be replaced with the new enterprise Avaya platform during fiscal year 2009 (see below).** An IP-enabled Nortel PBX is located at the South County Government Center which also supports an office two miles away via a remote shelf. About 10% of the telephones are IP sets.

A Nortel Networks Succession 1000M has been installed at the Health Department's Kelly Square location. This IP enabled PBX not only gave the department advanced capabilities, but it also took a significant resource load off the Massey PBX. This system was implemented several years ago, prior to the enterprise project. Voice communications to our smaller remote sites, including Libraries, Parks, Public Health Centers, etc., are served by various Toshiba systems and Siemens "Redwood" systems, all with integrated voicemail and Mitel SX-200.

A Nortel PBX is located at the PSCC (Public Safety Communications Center) for emergency calls, while administrative calls at this location are processed by a Nortel Succession 1000 PBX. The 911 Center will receive new equipment as part of their move into the new Public Safety Transportation Operations Center (PSTOC).

Police and Fire and Rescue stations – are on a Public Safety Voice network which is independent of the other county agencies. These are being upgraded to Nortel BCMs and are networked to a Succession 1000M configured as a Network Gateway Controller which will be integrated with the Health Department sites. This will allow Public Health and Public Safety personnel, located in different buildings across the County, to be integrated into a contiguous "First Responders" telephone network.

Other platforms include a ninety-six (96) port computerized conference bridge is located at the PSCC for predominately Police and Fire and Rescue operations. This conference bridge is provided by Octave, and is expandable to 192 ports; voice needs of our very small offices, i.e., small Human Services and community services sites are supported by carrier provided POTS service and single-line analog sets (some of these will be converted to IP phones off the enterprise system project). Various agencies also use centralized IVR services with connectivity provided via Verizon T-1 and numerous channel banks at distant sites. These services have greatly improved Fairfax County government's ability to provide quality services to its citizens and business clientele.

The County's VDS systems used to capture ACD historical statistics has been replaced with new hardware and a new application which provides Call Center statistics and metrics. This capability will eventually be replaced as a part of the Voice Modernization Project, but greatly improves the necessary statistics used by our Call Center managers to evaluate the County's response to County citizens.

The County is implementing a new Telecommunications Management System — Anchor Point which will significantly improve the management of the County's telephony systems and dramatically improve inventory, work order, and billing processes.

The convergence of voice, data and video traffic into a single network is the ultimate goal for the County's communication architecture (see section under Network Communications and I-Net). The County developed a strategic plan for replacing the disparate systems with an enterprise-wide voice communications solution. Implementation of the new voice solution is in its second year. The solution will use the latest technology that includes VOIP and will use the I-Net (fiber-optic network) as the backbone network that connects County facilities, to ultimately lower the County's circuit costs. A frame-work for a strategic direction to evolve the Counties communications capabilities and services was developed during an FY 2002 comprehensive study of the telecommunications architecture, including support issues, unique applications, and opportunities made available through the I-Net. FY 2006 saw the expansion of this strategic plan into a Request for Proposal (RFP) for the design, engineering, and implementation of a new County-wide voice platform. These plans and programs will help the County to meet the telephony needs and requirements of our citizens and employees. Eventually leveraging the high speed — high bandwidth connectivity provided by the County's fiber-optic network — I-Net, Fairfax County will have a fully integrated video, data and telephony Enterprise.

In FY 2007, the County began implementation of a new telephone architecture with and enterprise-wide VOIP capable system. This project will eliminate the diverse network of disparate legacy telephone systems with a contemporary telecommunications solution that will send call traffic over the County's I-Net infrastructure and integrate with the county's messaging platforms and IP based telephony applications. This effort will span several fiscal cycles.

5.5.4 Emergency Communications Network

The emergency communications networks that the County maintains are divided into two categories: Public Safety Radio Network and Public Service Radio Network.

Public Safety Radio Network

Voice Network — The County operates a digital, 800MHz trunked voice radio system that supports the operations of the Police, Fire and Rescue, and Sheriff's Departments, with more than 3,000 mobile and portable radios. This system infrastructure is also utilized by the County's Public Schools Security Department, and by the independent police department of the City of Fairfax, and the Towns of Herndon and Vienna. Equipment is located at eleven locations throughout the county, and all sites are linked together by a redundant VERIZON SONET network. The system provides for voice interoperability with and between the public safety agencies of Arlington County, City of Alexandria, Metropolitan Washington Airports Authority as well as the District of Columbia Fire department.

Mobile Data Network — To support operations of the various public safety agencies, the County operates a 450MHz mobile data communications system (MDCS) that ties the response vehicles of the Police, Fire and Rescue and Sheriff's departments to the County's Computer-Aided Dispatch (CAD) system, as well as access to various databases maintained by the Commonwealth of Virginia and the Federal Bureau of Investigation. This system consists of more than 900 Mobile Computer Terminals (MCT) and Vehicular Radio Modems (VRM) in vehicles of the various agencies, with transmitting equipment located at six sites in the County.

Public Service Radio Network

The County operates a second 800 MHz trunked radio system that supports more than 3,000 radios for the Department of Public works and Environmental Services, Public Schools Transportation (school buses), Park authority, FASTRAN, the CONNECTOR bus system, and other non-public safety County agencies. This seven-site system replaced a 1980s-era system that had limited coverage and performance in 2005.

Continuing in FY 2009, the County will remain fully involved in the FCC mandated 800MHz re-banding effort. This project is challenged by the need to do this while maintaining regional radio interoperability.

5.6 INTERNET ARCHITECTURE

The Fairfax County Internet architecture supports the County's E-Government program providing significant and wide-ranging opportunities to utilize emerging technology as a means of making information more readily available to County staff, citizens, and businesses. In addition, the interactive nature of the technology allows residents and others to conduct business (e.g., pay taxes, apply for permits, etc.) with the County at their convenience and from their location. Likewise, Internet technology allows access to enterprise data (real estate assessments, Human Services resource database, etc) without the need for a resident to call or visit the County Government center complex.

The e-Government architecture defines the standards, technologies and guidelines for public access, and conducting electronic business among County agencies, state agencies and outside entities. The County's Internet architecture is comprised of the following:

- **High Speed Connection to the Internet —** The County's fractional DS-3 connections to the Internet provides access to the Internet for County staff as well as outside access to the County's Web server(s) by residents, business, and others via the Internet.

- **Public Access Web Server —** The County's Public Access Web Server provides Internet users with a vast amount of information made available by various agencies within the County. The Web server can be viewed as an "on-line service counter" where residents and others may obtain information related to services, licenses, taxes, recreation, court filings, and so on. The Web server also acts as the distribution or collection point for information obtained from or provided to enterprise databases via an "Application Server."

- **Intranet Web Server —** The County InfoWeb Intranet Web server provides a portal access to County information and applications for agency and employee use.

- **Application Servers —** provide the gateway between the County Web servers and the information stored in County enterprise databases. The application servers do the work of communicating with various databases on the County mainframe and other platforms, accessing and collecting the requested information, formatting the information, updating the database where appropriate, and returning the result to the Web server for dissemination to the requestor. Application servers also provide additional levels of security to ensure that only allowable information is accessible.

- **The WebBoard Server(s) —** provide a mechanism for visitors to the County site to engage in ongoing discussions in either "real time" chat or, more commonly, by use of a localized version of Internet "newsgroup-style" discussion forums. These forums provide residents the opportunity to discuss a range of topics among themselves as well as with County officials and staff.

- **Interfaces —** between the County Application servers and the enterprise databases provide the link that allows access to data residing in a wide array of sources. The interfaces make it possible to access data from virtually all of the County databases: DB2, Oracle, SQL, MS Access and VSAM. The interfaces are comprised of "Application Program Interfaces" (APIs), Open DataBase Connectivity (ODBC), SOA, and other standards that enable the access layer of the web architecture.

5.7 SECURITY ARCHITECTURE

The Information Security Office defines the security standards and policies necessary to protect the information assets of the County. The security layer employs security principles coupled with a hardware and software infrastructure supported with applicable policies, plans and procedures. This architecture is designed to provide an appropriate level of protection for all County information processing resources regardless of platform and includes incorporation of industry best practices for overall reduction of risk.

The objectives of the information security program are to ensure confidentiality of information, integrity of data, systems and operations, technical compliance for HIPAA and PCI, privacy and to ensure availability of information processing resources. The information security program utilizes a multi-faceted approach to meet these objectives that includes research and implementation of threat reduction techniques, technological and managerial solutions when possible as well as implementation of awareness raising activities. The basic elements of identification and authentication, access control and monitoring of information processing activities are employed throughout the enterprise.

In view of the dynamic environment of information technology, the security architecture continues to evolve to meet the challenges arising with new technologies necessary to conduct e-Government activities. Identification and authentication, access control, and auditing functions are performed on the specific platforms using the capabilities inherent in the appropriate operating system. Policies, standards, software, hardware and processes are continually evaluated to modernize the infrastructure to permit the County to participate in e-Government activities while still providing secure access to County resources. Fairfax County has implemented a network architecture that takes a greater defense-in-depth approach to network security design.

Firewall technology is used as the main perimeter defense with all access from the Internet routed through the County's system of firewalls. In addition, the County uses broad filtering and routing at the firewall portion nearest the Internet connectivity, while more granular filtering and routing is exercised nearest the internal network connection. Classic authentication for each internal user is based upon a unique UserID (also called a sign-on or log-on)
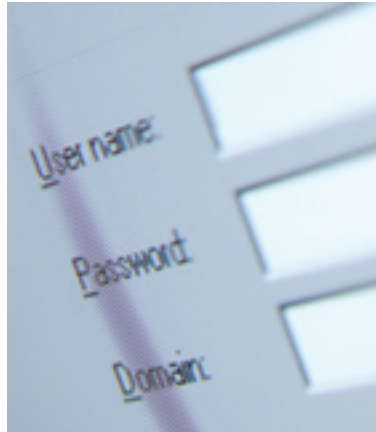
combined with a unique password. To improve the secure access and authentication to web-based applications as well as backend servers, the County has procured products to provide a solution that resolves today's security issues and positions DIT to leverage this investment and framework in the future. eTrust, through its SiteMinder module, provides a software platform of shared services that includes reduced sign-on, authentication management (who are you), and entitlement management (what you are allowed to do on the site) for web-based applications. eTrust also provides a secure reverse proxy solution that passes requests to enterprise backend content servers, and returns resources to the requesting client, thus allowing for a practical solution to the protection of internal assets. With Identity Management also being put in place, the County will be in a position to manage user profiles for both internal staff and public access, making personalized e-Government a reality. eTrust will continue to be expanded to provide a secure access and end-user authentication platform for internal and external users.

The County's network employs a private/public network model. Sensitive and critical assets are located on the private portion of the network while information and services available for public use are located on the public section. DIT will continue implementation of modularized, multiple firewalls supporting a variety of specialized application requirements. The County provides Dial-Up, VPN and Web Access technologies for remote users. Each of these requires security tokens and LDAP authentication for access. Remote access is approved at the same level as if the user were physically at his or her work site. Remote access is granted to those individuals who are approved telecommuters, users who periodically need to access County Systems from home or other locations, and individuals who need access while traveling. To enable the county to further realize return on investments made in remote access technology, the remote access program is being expanded to accommodate continuity of operations planning.

The County has implemented an Intrusion Detection System (IDS) to detect intrusions within the network and is in the planning stages of implementing an Intrusion Prevention System (IPS). IPS differs from IDS in their function of prevention versus detection. IPS devices are able to detect signs of an intrusion

or an intrusion attempt and pro-actively prevent it from happening. IPS provides capacity to perform real-time analysis of Intrusion attempts to determine if sensitive data, systems or network devices are being attacked or if a breach in confidentiality, integrity, or availability has occurred. The primary objective of Intrusion Prevention is to reduce possible damage and isolate /contain the malicious traffic. With the large quantities of log and alarm data generated by firewalls and sensors, the need for a specialized application to support the role of correlation was chosen and is in place. The IPS solution conducts a comprehensive threat assessment and allows for quick identification of credible threats to the organization in order to facilitate expedited response and containment of intrusions and malicious activity.

As mandates such as HIPAA and Procurement Card Industry standards become effective, the consequences of employees mishandling sensitive and confidential data have changed with new enforce-ment ramifications. Information security awareness activities are being implemented to effect a culture change for all employees. Through security conscious employees, realization of return on investment in security technologies can be leveraged further as overall risk to data and systems is reduced.

Security will continue to be a fundamental component of the County's e-business strategy. Fairfax County's secure network architecture takes a greater defense-in-depth approach to network security design. A method of network partitioning and the development of a modular infrastructure are being deployed to better shield important resources within the network. This modularity achieves the ability to control the traffic that flows to and from one area of the network to any other. In the process of creating these partitions, the County information technology assets utilized will be designed and configured with specific security requirements based upon their level of trust in order to serve specific purposes.